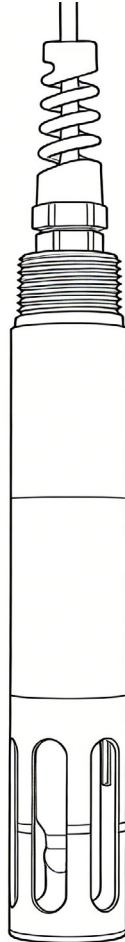


Online ORP Analyzer

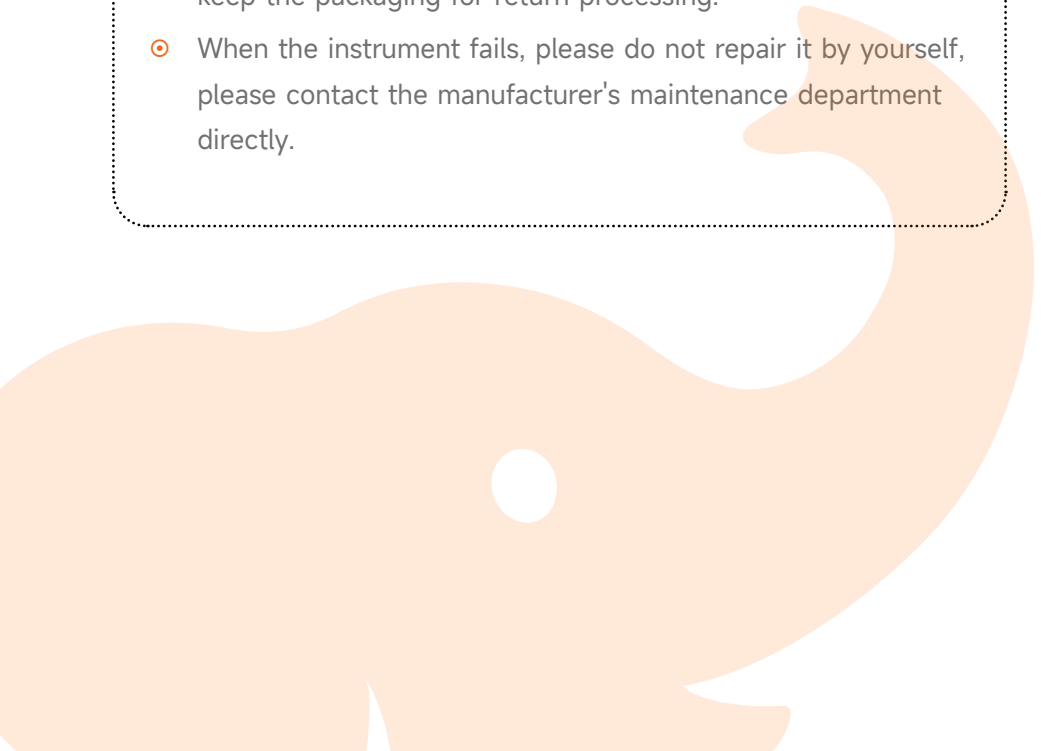


S-ORP041

User Manual

USER NOTICE

- ⦿ Please read this instruction manual carefully before use and keep it for reference.
- ⦿ Please follow the operating procedures and precautions in this manual.
- ⦿ When you receive the instrument, please open the package carefully and check whether the instrument and accessories are damaged during transportation. If damage is found, please notify the manufacturer and dealer immediately and keep the packaging for return processing.
- ⦿ When the instrument fails, please do not repair it by yourself, please contact the manufacturer's maintenance department directly.



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I. Instrument Introduction

The online ORP analyzer consists of a controller and an ORP sensor. The sensor outputs RS485 signals, offering stronger anti-interference capability in on-site applications. The controller is equipped with multiple output interfaces such as analog, digital, and switching signals.

1. Measurement Principle

The ORP electrode measures the oxidation-reduction potential by detecting the potential difference between the measuring electrode and the reference electrode. When the electrode contacts the solution, an electric potential is formed on its glass membrane, which needs to be compared with another constant potential provided by the reference electrode—this constant potential does not change with the ORP value of the solution.

2. Technical Specifications

Table 1-1 Sensor Technical Specifications

Measurement Parameters	ORP (Analog Electrode)	ORP, Temperature (Digital Sensor)
Measurement Method	Glass Electrode Method	
Measurement Mode	Immersion Measurement	
Range	ORP: (-2000~2000) mV	ORP: (-2000~2000) mV; Temperature: (0~60)°C
Measurement Accuracy	ORP: $\leq \pm 1\text{mV}$	
Repeatability	ORP: $\leq \pm 1\text{mV}$	
Resolution	ORP: 0.1mV	
Response Time	$\leq 10\text{s}$	
Power Supply/Voltage Consumption	/	(12/24)V DC/<0.3W
Communication Method	/	RS485 (Modbus RTU), Maximum Baud Rate 115200 bps
Overall Dimensions	156mm × ϕ 28mm	162mm × ϕ 28mm
Weight	0.5kg	
Material	POM	

Note: The analog electrode has no temperature output; the digital sensor has temperature output.

Table 1-2 Controller Technical Specifications

Display/Resolution	3-inch industrial color TFT display (800*480 resolution)
Controller Dimensions	96 mm * 96 mm * 132mm
Power Supply	(85~265)VAC
Power Consumption	< 2W
Storage Temperature	(-20~70)°C
Operating Temperature	(-10~60)°C
Housing Material	ABS
Protection Level	IP55
Analog Output	1 channel (4~20)mA analog output, maximum load 500 ohms
Relays	3 channels of SPDT relays (250VAC, 30VDC/MAX 5A)
Digital Output	1 channel RS485 output
Weight	0.5kg
Material	POM

3. Sensor Dimensions

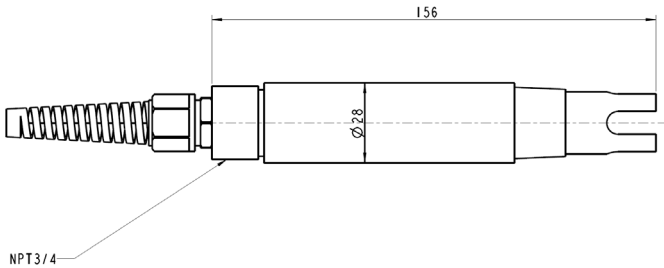


Figure 1-1 Installation Dimension Diagram of Analog Electrode

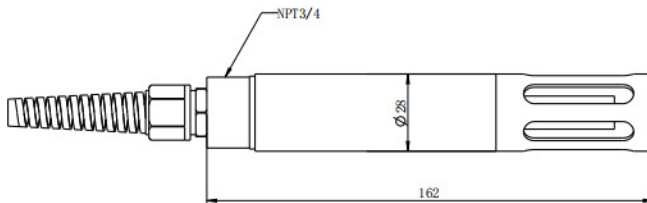


Figure 1-2 Installation Dimension Diagram of Digital Sensor

4. Features

- ⦿ Integrated all-in-one design with anti-electromagnetic interference;
- ⦿ Industrial online composite electrode for long-term stable operation;
- ⦿ IP68 protection level, suitable for various working conditions;
- ⦿ RS485 signal output with standard Modbus protocol, facilitating integration and networking.

5. Application Fields

- ⦿ Water quality monitoring in sewage and industrial wastewater treatment processes and discharge outlets;
- ⦿ Water quality monitoring of drinking water intake and in-process treatment;
- ⦿ Surface water and groundwater monitoring.

II. Installation

1. Unpacking the Instrument

After opening the package, carefully inspect the instrument for damage during transportation. If damaged, document the details and report the loss to the carrier, the company's agent, or the customer service department.

2. Function Check

The sensor has undergone detailed testing before leaving the factory. Only a brief function check is required before installation:

- ⦿ Connect the sensor to the controller and power on the controller;
- ⦿ The controller will complete self-test quickly and enter the measurement interface;
- ⦿ Do not remove the protective bottle on the electrode at this time. If the display indicates the sensor is operating normally, the function check is complete.

Note: The sensor contains a glass electrode. Avoid strong mechanical impact. There are no user-serviceable parts inside the sensor.

3. Connecting the Sensor to the Controller

01. Hard-Wired Connection of ORP Sensor

- ⦿ If powered on, disconnect the controller's power supply, unscrew the 4 screws on the bottom panel of the controller, and open the panel;
- ⦿ Pass the cable through the controller's locking joint and connect it to the internal terminal block. Refer to Table 2-1, Figure 2-1, Figure 2-2, and Figure 2-3;

- Tighten the locking joint, close the panel, and secure it with screws.



Figure 2-1 Wiring Diagram of Analog Electrode



Figure 2-2 Wiring Diagram of Digital Sensor

Table 2-1 Sensor Wiring Definition

Sensor Type	No.	Wire Color	Wiring Definition	Controller Interface
Analog Electrode	1	Transparent wire (middle signal wire)	pH/ORP, ORP measuring terminal	11
	2	Shielded wire	REF, ORP reference	12
Digital	1	Red	S_12V, +12V power input terminal	15
	2	Brown	S_GND, power input ground terminal	16
	3	Gray	S_485A, RS485 input terminal_A	17
	4	Yellow	S_485B, RS485 input terminal_B	18

02. Controller Wiring

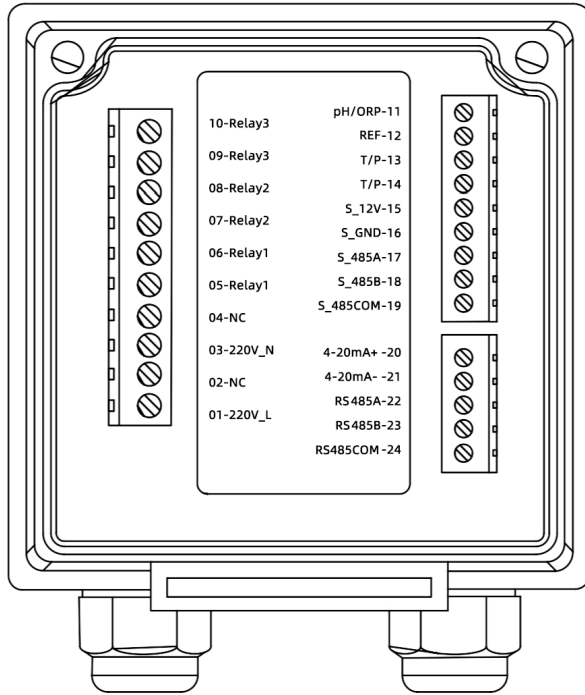


Figure 2-3 Controller Wiring Diagram

Table 2-2 Controller Wiring Definition

Controller Interface	Mark	Definition
1	220V_L	AC (85-265)V live wire input terminal of the controller.
2	NC	Empty
3	220V_N	AC (85-265)V neutral wire input terminal of the controller.
4	NC	Empty
5~10	Relay1, 2, 3	3 channels of switching signal (250VAC, 30VDC/MAX 5A) output, normally open.
11~14	Sensor	Analog electrode connection interface.
15~19		Digital sensor connection interface.
20~21	4-20mA	4-20mA analog output, maximum load 500 ohms.
22~24	RS485	RS485 output of the controller.

4. Controller Wiring

01. Wall-Mounted Installation

The wall-mounted installation method of the controller is shown in Figure 2-4.

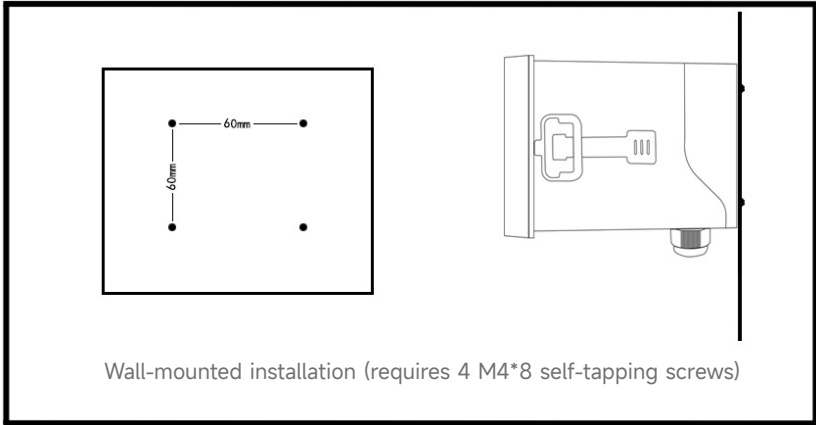


Figure 2-4 Wall-Mounted Installation of Controller

02. Panel Embedded Installation

For panel embedded installation, a hole needs to be drilled on the panel, and an additional mounting fixture is required, as shown in Figure 2-5.

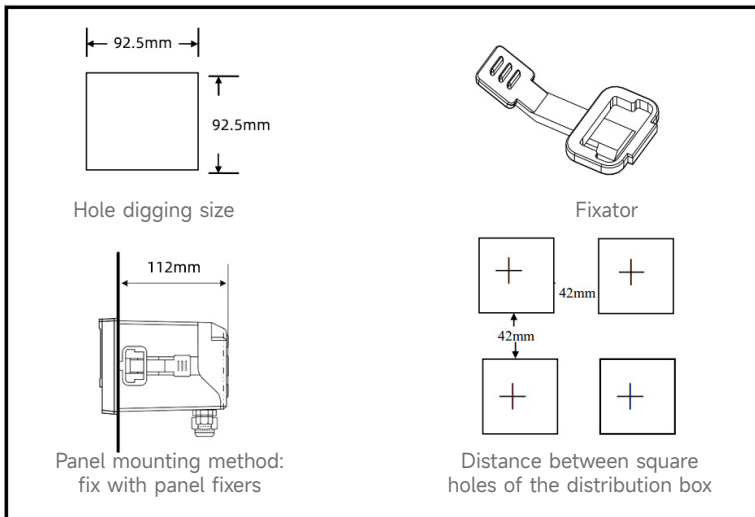


Figure 2-5 Panel Embedded Installation of Controller

5. Sensor Installation

The ORP sensor is equipped with an NPT3/4 threaded interface at the tail, suitable for various applications such as pipelines, pools, rivers, and lakes, as shown in Figure 2-6.

Note: When installing the sensor in place, ensure the protective bottle on the electrode is removed; otherwise, the sensor cannot measure normally.

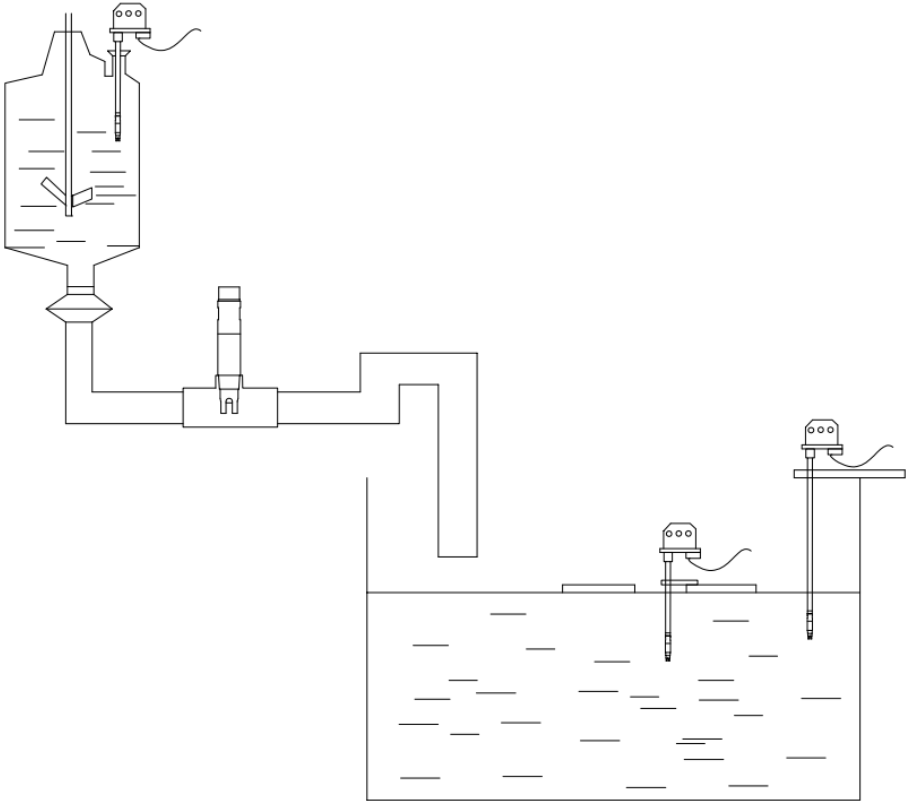


Figure 2-6 Installation Diagram

III. Controller Operation

1. Controller Overview

The controller has complete external interfaces, facilitating sensor networking, remote control, fault diagnosis, etc.

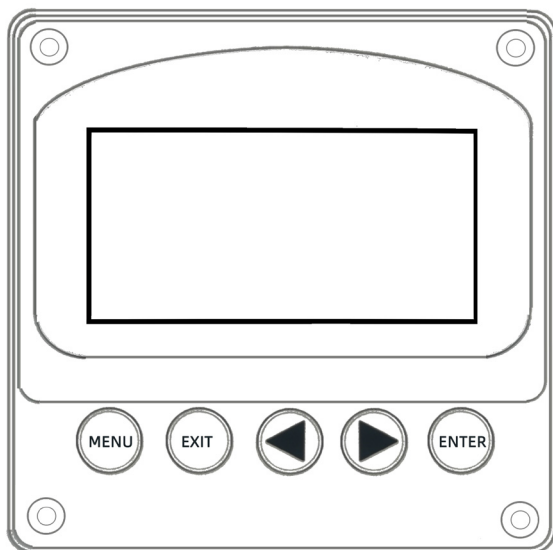


Figure 3-1 Key Diagram

Table 3-1 Key Function Introduction

Mark	Key Name	Function Description
MENU	Menu Key	Enter the menu from the "measurement interface"
EXIT	Return Key	Return to the previous interface
◀	Left Shift Key	In the "menu interface": cycle left to select relevant menus In the "submenu interface": cycle left to select relevant parameters
▶	Right Shift Key	In the "menu interface": cycle right to select relevant menus In the "submenu interface": cycle right to select relevant parameters
ENTER	Confirm Key	Enter the submenu or confirm modifications from the "menu interface"

2. Value Display Interface

After power-on, the controller will enter the self-test interface. After about 15 seconds, it will display the value interface, where you can view sensor status, measurement data, relay status, etc.

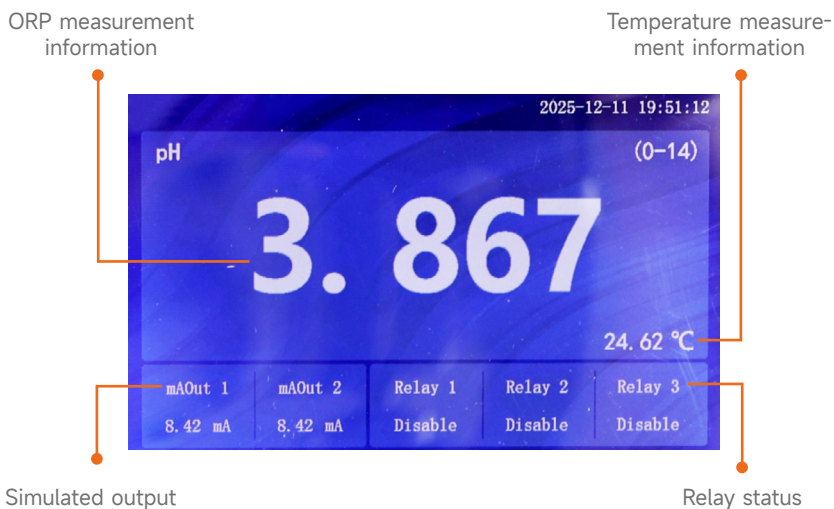


Figure 3-2 Display Interface

3. Controller Settings

Press the “MENU” key on the value display interface to enter the controller menu interface. Users can select the corresponding submenu to set the controller parameters.



Figure 3-3 Controller Menu Interface

Table 3-2 Controller Menu Function Introduction

Controller Submenu	Submenu Function Description	
Device Information	Displays information about the controller and sensor, including model, serial number, production date, hardware version, software version, etc.	
Calibration	Performs calibration operations on the sensor (see 4.2 for details).	
Parameter Settings	Temperature Mode	Set the temperature value to automatic sampling or manual input
	Restore Factory Setting	Restore default calibration coefficients if calibration is incorrect
Analog Output	Sets analog output parameters.	
Relay	Sets relay output parameters.	
Alarm Settings	Sets upper and lower alarm limits.	
Communication Settings	Sets the external communication address and baud rate of the controller.	

▶ Analog Output

On the menu interface, press the left/right shift keys to select “Analog Output”, press “ENTER” and choose “Analog Output Configuration” to enter the analog output submenu interface, as shown below:

- a. Select the working mode: “Disabled”, “ORP”, “Temperature (ORP)”;
- b. Set the ORP value or temperature value corresponding to 4mA and 20mA as needed on-site. Press “Save Settings” to confirm.

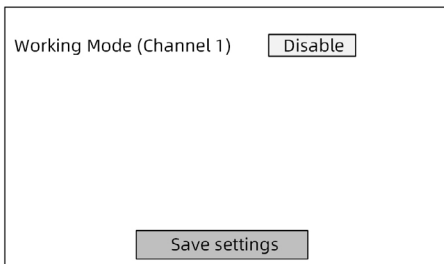


Figure 3-4 Analog Output Settings a

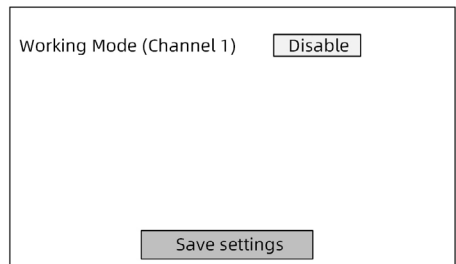
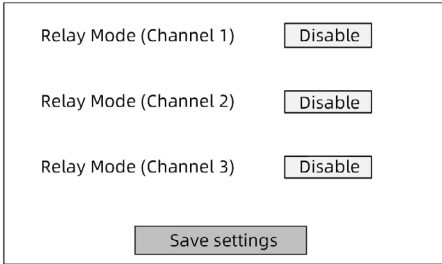


Figure 3-4 Analog Output Settings b

► Relay

On the menu interface, press the left/right shift keys to select "Relay", press "ENTER" to enter the relay submenu interface, as shown below:

- Select the working mode: 6 modes including "Disabled", "Fault", "Upper Limit", "Lower Limit", "Upper & Lower Limits", "Manual";
- Select the relay working mode and corresponding parameters as needed on-site. Press "Save Settings" to confirm.

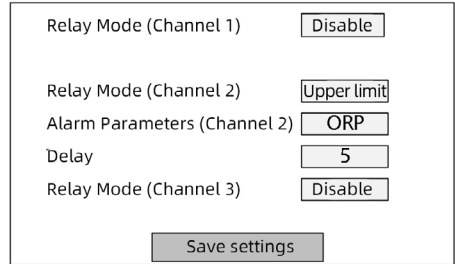


Relay Mode (Channel 1)

Relay Mode (Channel 2)

Relay Mode (Channel 3)

Figure 3-5 Relay Settings a



Relay Mode (Channel 1)

Relay Mode (Channel 2)

Alarm Parameters (Channel 2)

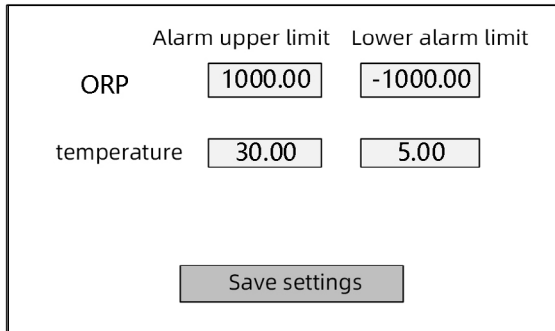
Delay

Relay Mode (Channel 3)

Figure 3-5 Relay Settings b

► Alarm Settings

On the menu interface, press the left/right shift keys to select "Alarm Settings", press "ENTER" to enter the alarm settings submenu interface, as shown below. Set the upper or lower alarm limit as needed on-site and press "Save Settings" to confirm.



	Alarm upper limit	Lower alarm limit
ORP	<input type="text" value="1000.00"/>	<input type="text" value="-1000.00"/>
temperature	<input type="text" value="30.00"/>	<input type="text" value="5.00"/>

Figure 3-6 Alarm Limit Settings

IV.Maintenance and Troubleshooting

1. Daily Maintenance

- ⦿ Cable Inspection: Check all connected signal and power cables for breaks;
- ⦿ the instrument will not work properly if cables are broken;
- ⦿ Appearance Inspection: Check the controller and sensor housing for damage and corrosion;
- ⦿ Equipment Cleaning: Regularly clean the controller and sensor. Rinse the glass electrode with clean water;
- ⦿ Sensor (Analog Electrode) Replacement: Replace periodically (electrode service life is about 1 year) according to the wiring method in 2.3;
- ⦿ Electrode Replacement: The digital sensor can independently replace the ORP electrode (service life is about 1 year) as follows:
 - ▶ **Step 1:** Remove the protective cover;



Figure 4-1 ORP Electrode Protective Cover Disassembly Diagram

- ▶ **Step 2:** Remove the old electrode with an electrode disassembly tool. Avoid splashing water into the electrode slot during disassembly; if splashed, fully dry the inner wall and bottom with paper towels;



Figure 4-2 ORP Electrode Disassembly Diagram



Figure 4-3 ORP Electrode

- ▶ **Step 3:** Remove the mounting parts from the old electrode and install them on the new electrode;

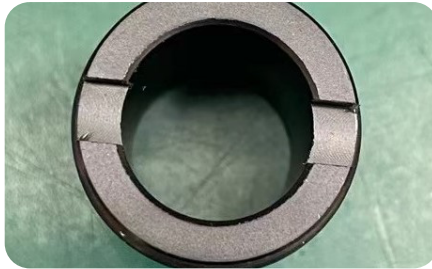


Figure 4-4 ORP Electrode Mounting Parts

- ▶ **Step 4:** Reinstall the new electrode and reattach the protective cover. Avoid splashing water into the electrode slot during installation; if splashed, fully dry the inner wall and bottom with paper towels.



Figure 4-5 Installing the New Electrode

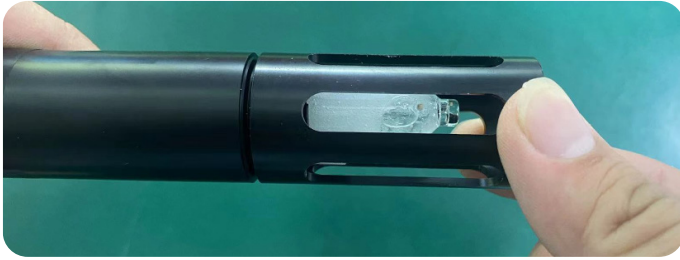


Figure 4-6 Installing the Protective Cover

2. Calibration

Factors such as component aging of the ORP sensor and changes in the installation environment will affect measurement results. Regular calibration is required to overcome these impacts (calibration cycle depends on conditions, usually 3 months for surface water).

Use professional ORP standard solutions. Immerse the ORP sensor in the standard solution and start calibration only after the signal value stabilizes.

- ▶ **Step 1:** Enter the calibration interface;
- ⦿ On the measurement interface, press the “MENU” key to enter the menu interface;
- ⦿ Press the left/right shift keys to select “Calibration”, press “ENTER”, and choose “ORP” to enter the calibration interface, as shown in Figure 4-7.

Calibration mode	Two point calibration	Current value	259.36
ORP Standard solution value	Signal value	Cancel	
86.00	154.115	confirm	
256.00	338.233		
Start calibration			

Figure 4-7 Sensor Calibration Interface

There are 2 calibration modes: “Single-Point Calibration” and “Two-Point Calibration”. “Two-Point Calibration” is recommended for general use.

The default ORP standard solution values are 86 and 256. It is recommended to use these values for calibration; manual modification is required if other values are needed.

▶ **Step 2:** Calibration value collection;

- Prepare the standard solution in advance and immerse the sensor in the first standard solution;



Figure 4-8 Calibration Schematic Diagram

- Observe the "Signal Value" (in mV). Wait for it to stabilize (judgment standard: the difference between the maximum and minimum values within one minute is less than 1mV);
- Press the "Confirm" button to stop data refreshing;
- Enter the ORP value of the standard solution in the input box corresponding to "ORP Standard Solution Value" to complete the data collection for this point;
- Repeat the above process to collect the next calibration point value.

▶ **Step 3:** Calibration confirmation;

After confirming that all signal values are normal and collected, press "Start Calibration" to complete the calibration.

▶ **Temperature Calibration**

- On the measurement interface, press the "MENU" key to enter the menu interface;
- Press the left/right shift keys to select "Calibration", press "ENTER", and choose "Temperature" to enter the temperature calibration interface, as shown in Figure 4-9;
- Immerse the sensor in the aqueous solution. After the temperature reading stabilizes, press the "Confirm" button next to the signal value;

- Enter the standard temperature value of the aqueous solution in the temperature value box;
- Press the "Start Calibration" button below to complete the calibration. The default temperature value is 25, which needs to be modified according to the actual water temperature.

The screenshot shows a calibration interface with the following elements:

- Calibration mode:** Temperature calibration
- Current value:** 24.38
- temperature value:** 24.38
- Signal value:** 25.02
- Buttons:** Cancel, Start calibration

Figure 4-9 Temperature Calibration

3. Electrode Cleaning and Storage

Keeping the surface of the ORP glass electrode clean is crucial for accurate measurement data. Regularly check for contaminants on the glass electrode during use. Rinse with clean water if contaminated; do not wipe with hands or other hard objects. For long-term storage, immerse the electrode in 3mol/L saturated potassium chloride solution.

Note: Do not store the ORP electrode in distilled water, as this may cause electrode failure.

4. Troubleshooting

Problem	Possible Causes	Solutions
Communication Abnormality	Power supply or cable connection issues, baud rate mismatch	Check the power supply, verify correct RS485 connection, confirm baud rate consistency
Unstable Values	Expired glass electrode, bubbles in the measured solution, calibration errors, signal interference	Test the ORP electrode signal with standard solutions; check if the glass electrode is expired. Recalibrate. If the problem persists, check the power supply, verify correct connection of the shielded wire, or contact after-sales service

V. ORP Reagent Formulas

- ⦿ ORP = 86mV at 25°C
Take 100mL of pH=7 standard solution into a beaker;
Add 10mg of hydroquinone quinone and stir thoroughly.
- ⦿ ORP = 256mV at 25°C
Take 100mL of pH=4 standard solution into a beaker;
Add 10mg of hydroquinone quinone and stir thoroughly.

Note: Seal and store the above reagents at room temperature; validity period: 3 days.

VI. Controller Modbus Communication Protocol

Register Address	Message Address	Data Type	Read/Write	Length	Description
40001	0x0000	Float	R	2	ORP Data
40003	0x0002	Float	R	2	Temperature Data



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